DETERMINATION OF TIME SPENT MANUALLY PERFORMING FOOOSERVICE INVENTORY ACTIVITIES IN A SMALL COMMUNITY HOSPITAL

by

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INTRODUCTION

The healthcare industry has been faced with many challenges during the past decade. Increased emphasis on competition, changes in the financing of healthcare, declining admissions and length of stay, and growth of alternate forms of medical care delivery have resulted in lay-offs, and hospital closures (1-3). Harju and Sabatino (4) reported results of a survey conducted by the American Hospital Association (AHA) which indicated more than half of U.S. community hospitals had initiated major productivity programs in 1983 and almost 60% had such a program planned for 1985. According to Hoover (5), foodservice directors will be challenged during the 1980's to provide a high level of services cost effectively, in a competitive environment, under considerable economic pressure. Tuthill (6) indicated the demand for cost cutting presented a challenge to foodservice managers trying to maintain a high level of quality and increase productivity with fewer employees.

Mitchell (7) stated inventories comprise a major portion of hospital's assets. Hoover (5) predicted foodservice resource management will move toward inventory management techniques which minimize investment and assure economic order quantity. According to Montag and Hullander (8), inventory control affects the success and failure of organizations handling physical items.

Aardsma's (9) report of a AHA survey of U.S. Hospitals indicated that on the average, hospitals were maintaining three months supply of inventory. He contended such stock levels implied ineffective

management of inventories. To achieve efficient management of inventories, he recommended hospitals reduce the number of days of inventory on hand, thereby increasing inventory turnover.

Several authors have discussed the use of computers for controlling inventory (6, 10-17). Tuthill (6) asserted that use of manual methods were no longer appropriate due to availability of computer technology and increased need for current reports for decision-making. Schwartz (18) discussed the difficulties of automating inventory activities without having first performed these activities manually. Andrews (19) and Aldrich and Helbig (20) concurred that good manual procedures should be established before automation was introduced. Tuthill (6) and Pellegrino (21) encouraged comparing costs to produce records manually with costs to produce the same records using a computer.

Objectives

The purpose of this study was to measure time spent manually performing foodservice inventory activities in a small community hospital. Results of this study will provide data which can be used for analyzing the cost of automating inventory functions.

Specific objectives of the study were to:

* compile a list of activities performed in a foodservice department for maintaining inventory;
* determine actual time spent performing perpetual inventory activities manually; and
* determine actual time spent performing physical inventory activities manually.

Limitations

Data collected reflect information on inventory activities performed manually at the study site. Generalizations to other foodservice operations would be dependent on similarities of inventory activities.

REVIEW OF LITERATURE

Inventory Management

According to Andrews (12), inventories pass through a four-phase cycle: first, an order is placed and received; then stock is used until a reorder point is reached at which time another order is placed; more stock is used before the new order is received; and finally, the new order is received. The reorder point and economic reorder quantity are decisions that create and control inventories.

Shaughnessy (22) stated effective control of inventory required a definition of inventory level and an effective means of measurement. He contended application of aggregate control and measurement systems would not cause inventory levels to change but would bring to the attention of management the movement trend, the degree of variance against trend, and the effect of any action plan to change inventory level.

Rakowski (23) described "unofficial" inventory as those items deleted from the master inventory record, but not yet used. He discussed two methods for solving the unofficial inventory problem: minimize physical existence of unofficial inventory, and incorporate unofficial inventory into standard inventory management systems.

Spears and Vaden (24) defined inventory as stores of goods and products. They emphasized that food, beverages, and supplies in storage areas must be considered as valuable resources of the operation and treated accordingly.

Objectives of Inventory Control

Andrews (12) identified four objectives of an inventory control system: prevent production schedule interruptions caused by shortages of materials; purchase supplies at a minimum cost; minimize losses due to theft, obsolescence, and spoilage; and keep investment in inventories at the minimum point consistent with production requirements. She contended information on optimum reorder point and economic reorder quantity was necessary to pursue these objectives.

DeWelt (25) stated a major objective of a production inventory control system must be to get the right item at the right time. He believed excess inventory was the result of having the wrong items too early or having the right items late.

Spears and Vaden (24) identified three major objectives of inventory control: maintain quality of goods and supplies, minimize inventory cost, and ensure adequate quantity on hand for production and service needs. They stated effective inventory control demanded controlling access to storage areas, requiring authorized requisitions for removing goods from storage, and monitoring inventory levels.

Inventory Types

According to Carlson and Gilman (26), two main purposes of inventory records are to state the correct value of inventory and provide information for production control decisions. Inaccurate inventory status could cause unnecessary costs and delays, stockouts, overstocks, and uneconomical decisions on replenishment of orders.

Reuter (27) suggested a count of inventory items be maintained on perpetual records, which would indicate the running or current balance of each inventory item through the posting of receipts and disbursements. He cautioned, however, that such perpetual records never stay completely accurate, so physical counts should be made to verify the perpetual records.

Spears and Vaden (24) stated an inventory control system required maintaining accurate records. Physical inventory records show the actual count of inventory items in all storage areas at specific times and perpetual inventory records show a continuous record of all purchases and food issues, thereby providing quantity on hand at any given time. Depending on the size of the operation, physical inventory can be done once a month or two to three times a year. Perpetual inventories require considerable labor to maintain and are only used in large operations that carried large inventories.

Inventory Control Tools

ABC Method. According to Reuter (27), the ABC concept of inventory control proposes that items in inventory are not of equal importance. Time, effort, money, and other resources should be allocated among items in proportion to their relative value. Items are therefore categorized as A, vital; B, moderate; or C, trivial items. Benefits can be realized through reduced inventories by identifying only A items for concentrated attention.

Spears and Vaden (24), applying the ABC concept in foodservice, suggested inventory items be divided into three similar categories:

A items which represent only 15 to 20 percent of inventory items, B items which constitute about 20 to 25 percent of inventory items, and C items which make up to 60 to 65 percent of inventory items. Foodservice managers using the ABC method would spend more time controlling the high value-low volume items, and less time on low value-high volume items.

Minimum-Maximum Method. According to Spears and Vaden (24), the Minimum-Maximum Method of controlling inventory involves establishment of minimum and maximum inventory levels. Usage rate of an item is determined by historical data. A reorder point is established taking lead time into consideration. They define the minimum level as the lowest stock level that can safely be maintained to avoid stockout or emergency purchasing and the maximum inventory level as equal to the usage rate plus safety stock. Safety stock is the minimum quantity below which the inventory should not fall under normal circumstances.

Economic Order Quantity. Montag and Hullander (B) stated the primary objective of the Economic Order Quantity (EOQ) model was cost minimization. The basic EOQ model makes several assumptions: item demand is known and constant; withdrawals are at a constant rate; quantity purchased is available instantaneously; shortages are not tolerated; and unit, order, and carrying costs are constant. They encountered difficulties applying the EOQ model to foodservice because several basic assumption were violated: item demand was

uncertain, withdrawals were discontinuous, unit cost was dependent on price breaks, lead time was not constant, shortages occurred, and order placement and carrying costs varied.

According to Fullbright (28), the objective of EOQ is to compute an order quantity for an item that will minimize the sum of the annual order cost and holding cost associated with the order quantity. EOQ should not be used if demand for inventory varies significantly, as with seasonal fluctuations.

Spears and Vaden (24) suggested not using EOQ in foodservice operations unless data processing equipment is available. The cost of maintaining EOQ would not be justified for inventory analysis of items that account for very little of the total inventory cost.

Inventory Valuation Method

Andrews (13) identified three commonly used inventory valuation methods and discussed each in terms of costing issues. In the First-In-First-Out (FIFO) method, items purchased first are issued first and the actual cost paid for each item is used. In the Last-In-First-Out (LIFO) method, items purchased last are issued first and the actual cost paid for each item is used. The moving average method requires computation of purchase price averages. Andrews stated that consistency was more important than the type of valuation method used.

Spears and Vaden (24) discussed various valuation methods in terms of the conventional inventory valuation method, beginning

inventory plus purchases less ending inventory. The FIFO method uses latest purchase price to value inventory while the LIFO method uses the oldest purchase price. The average cost method uses an average of purchase prices. A fourth inventory valuation method, the specific identification method, involves pricing inventory at the exact cost of the item. The method chosen for valuing inventory is important because it affects the determination of the value of inventory. Generally, value of inventory would be lowest using LIFO and highest using FIFO.

Computerization in Foodservice

Historical Perspective

In 1974, Balintfy (29) predicted computer use trends in institutional foodservice. He identified three evolutionary stages: simple electronic data processing, which would automate tasks done by hand; increased interaction between computers and foodservice managers in all foodservice operation functional units; and use of computers as decision-making tools.

Youngwirth (30) reported that pioneer research on foodservice computer application was done by Dr. Joseph Balintfy at Tulane University. His work, the Computer Assisted Menu Planning (CAMP) program, was designed to assist foodservice managers plan menus. Youngwirth also discussed research in foodservice computer applications at the University of Missouri Medical Center at Columbia.

Matthews and Norback (31) noted that computer use for dietetic and foodservice applications was very limited between 1958 and 1981. Batch mode processing was the method used to deliver information to dietitians and foodservice managers and computer use appeared to be concentrated on routine tasks. With the advent of technological changes in the 1970's, emphasis on computer usage changed from operational applications to development of decision-support systems for managers.

Trends in Hospital Computer Use

Jackson and Jensen (32) reported results of a survey of 450 hospital administrators by a National Research Corporation (NRC), which indicated nearly 75% of hospitals surveyed, bought hardware and software in 1983 to cope with Medicare's new prospective payment system. Based on another NRC survey, Jensen and Miklovic (31) stated that 50% of hospitals planned to purchase software and 40% would buy hardware in 1985.

Money Spent on Computers. Dorenfest (34, 35) noted a continued increase in community hospital expenditures for computerized information systems from $1.3 million in 1979 to $3.3 million in 1984. Packer and the research staff of Shared Data Research (36) examined selected changes in data processing activities of 2,500 hospitals in a survey conducted in 1981, and again in 1984. They observed in 1984 an average increase of 65% in the hospital data processing budgets from their 1981 budgets. In 1985, hospital data processing

budgets increased by 16.6% of the 1984 data processing budget (37). Actual data processing expenditures from 1985 to 1986 rose by 15.8%, a total of $3.5 billion (38). Packer (38, 39) projected data processing costs would rise from 3.34% of total hospital budgets in 1986 to approximately 4.10% in 1987, a $3.9 billion increase.

Types of Computers Used. Jensen and Miklovic (33) reported personal computer use increased from five out of ten hospitals in 1983, to six in 1984, and eight in 1985. Most administrators (70%) used personal computers for spreadsheet analysis and data base management.

Dorenfest (35) has monitored trends in microcomputer usage of 250 community hospitals since 1979. He reported that in 1980, none of the 250 community hospitals surveyed used microcomputers. At the end of 1984, 218 (87.2%) were using microcomputer hardware. The number of microcomputers rose from 46 in 1981 to 2,399 by the end of 1984. Dorenfest (35) forecasted that due to low cost and ease of use, microcomputers would continue to assist department heads achieve automation objectives, cause delay in purchase of mainframe computers, and decrease cost of computerization in the hospitals.

Packer (39) indicated declining interest in mainframe and minicomputer capability had been offset by increasing demand for personal computer capability. He reported a 39.7% increase in personal computer usage in hospitals' financial planning and operational departments. Packer predicted that data processing personnel and

mainframe hardware costs will plateau in 1988. However, cost of acquiring personal computer hardware and software was projected to increase in 1987 and 1988.

Computer Applications in Foodservice Research

Ferrence (40) investigated the present and future use of computers in college and university foodservice and evaluated the effect of computer use on employee skill requirements. Results obtained from two mail questionnaires showed 45 (53%) of the respondents used computers. Sophisticated decision making functions were least utilized; accounting and inventory functions were utilized to the greatest extent; and reports pertaining to production, sales and cost analysis, purchasing, and the use of standardized recipes showed the most potential for future use. No significant correlations were found between number of meals served per day and use of the computer and functions utilized. An upgrading of skill requirements for the non-supervisory, supervisory, and administrative personnel was noted in computerized operations.

McCool and Garand (41) surveyed 2,064 institutional foodservice managers to collect data on characteristics of the institutions using computers, types of computers in use, reasons for use and non use of computers, and the types of computer applications being used. Results indicated greater computer usage in larger institutions. Educational institutions reported the greatest use of computers, with

mainframe systems predominating. Lack of capital was the primary reason given for not using computers. Computers were used most frequently for managerial information applications.

Evaluation of Computerized Foodservice Systems

VanEgmond-Pannell (42) described computerization of the Fairfax County School District foodservice operation in Fairfax, Virginia. The goal was to computerize at the point-of-sale level to increase controls of financial matters, relieve managers from routine work, increase productivity, reduce inventory at each site through improved ordering, and provide management with sound and timely information. VanEgmond-Pannell stressed the importance of planning for computerization because to be effective, implementation takes time. Considerations in implementation should include assessing operational needs and understanding what computers can and cannot do.

Patterson and Alvarez (43) explained the general capabilities of current foodservice computer systems and discussed how these systems could be used to enhance productivity, decision-making, and operational control. A decision to buy and install a system should be based on the realization that data entry requires time. They believed a properly planned system would help an operation stay competitive.

Kasavana (44) cited the importance of system selection and discussed the potential problems in evaluation of automated foodservice inventory control systems. He identified three major areas of concern for selecting a system: ingredient definition, concept standardization,

and ease of use. Does the system distinguish between purchase unit, issue unit, and recipe unit? Are the concepts of inventory usage, variance, and valuation defined by the computer, and if so, are they similar to the procedures presently used? Are the data files easy to update to ensure accurate and current information?

According to Cummings and Robinson (45), the growth of computer technology has created a confusing variety of equipment and programs. The incompatibility of computer systems installed without consideration to integration was identified as a cause of computer confusion. Management strategies for creating efficient information systems included assessing current and future system use, examining software and hardware capabilities, evaluating potential vendors, and networking with system users.

Fowler (46) had many concerns on the proliferation of software. She suggested foodservice managers evaluate software packages before purchasing one. Managers should develop goals, assess need, review software functions, develop a request for proposal (RFP), and analyze software features and costs before selecting a system(s).

Aldrich and Helbrig (20) presented a sequential procedure to follow when considering initial implementation of a computer-based information system (CBIS). The procedure for CBIS implemention was to analyze existing systems for potential use of CBIS, formulate a plan, and select system software and hardware. After implementing the CBIS, it should be evaluated. They emphasized that computerization is indicated only when a manual system exists.

Pellegrino (21) discussed a process for selecting a computer system for foodservice organizations. The cost of the existing manual system should be compared to the cost of a new computerized system to determine if the cost of a new system can be justified.

Packer (47) cited hospital bed size and the annual data processing budget as factors affecting the type of system that will best meet a hospital's needs. Evaluation of needs, in addition to evaluation of vendors, their systems, and their services, is important before investment in an information system.

Computerized Inventory System

Johnson and Moore (10) investigated the use of electronic data processing for inventory and cost controls and developed a model that could be used by other organizations. The model included programs for maintaining perpetual inventory, writing purchase orders, and providing reports for analysis of purchases and issues. They stated dietitians, working with experts, could devise computer programs for perpetual inventory purchase and issue reporting.

Andrews and Tuthill (11) described a computer-based materials management system at the University of Missouri Medical Center foodservice. The system included inventory, food cost accounting, menu planning, and micrologistics. The primary purpose of the inventory control system was to automate purchase of food and supplies from a central purchasing department. The system maintained a perpetual inventory, costed food purchases and issues, and provided other information used in controlling materials management.

Hart (15) described how the University Hospitals of Cleveland, a 985-bed complex, reduced costs for food and labor through the use of computerized systems which included inventory management. All food and supply items were listed in the inventory file with corresponding yield and cost. Requisitions were printed for all ingredients based on forecast production needs. Managers were free to manage the operation because paperwork was completed automatically.

Wilcox et al. (16) designed an automated system incorporating menu item forecasts into a computerized inventory system to tighten control of frozen food purchasing. The inventory control subsystem maintained a perpetual inventory, generated recommended amounts to buy, and provided summary reports of purchases by vendors and issues by the cost center. Results from a two-week test indicated excessive stock had previously been maintained for many items and use of the computer system helped reduce stock levels. The system modification was considered a success.

Tuthill (6) reported that in 1965, the Department of Dietetics at the University of Missouri Medical Center utilized five full-time equivalent employees to maintain their manual system for purchasing food, maintaining a perpetual inventory, costing of inventory, requisitioning food from storage, and adjusting recipes. In 1980, the number of full-time equivalents did not increase with computerization but the output of the entire operation increased considerably.

Based on a survey of over 1,000 key hospital personnel, Louden et al. (17) reported inventory management was the most frequently

implemented computer application in cost containment programs. Packer and the research staff of Shared Data Research (36) also reported an increase in installation of hospital inventory control systems between 1981 to 1984.

Ferrence (40) investigated the present and future use of computers in college and university foodservices. Accounting and inventory functions were reported to have been utilized to the greatest extent.

Comparative Studies on Manual vs. Computerized Management Systems

Hicks et al. (48) developed three scenarios typical in food-service operations and compared cost of manually producing information with the use of Interactive Foodservice Decision Assist Method (IFDAM), a computer program written by Hicks. In the first scenario, prices of 349 ingredients were changed according to quotations of potential vendors. Obtaining cost information with IFDAM took 1.5 hours. Obtaining similar comprehensive data would be a monumental task to do manually and was not undertaken. In the second scenario, eight new ingredients, 13 menu items, and two menu plans for two different types of holiday meals were entered in the computer. Use of IFDAM in menu planning required one hour to complete compared to 12 hours if done manually. In the third scenario, cost comparisons were made of 27 different menu items for one patient day. The calculations took one hour with the use of computers and approximately nine hours manually. The authors concluded IFDAM program is a decision support system which will process information more efficiently.

Mayfield (49) implemented a computerized inventory system in a 100-bed community hospital in 1985; a 23% increase in inventory turnover ratio, 13% decrease in food cost, and a decrease in substitutions over the last three years occurred. Approximate times for performing inventory activities manually and using a computer were compared. Valuing monthly inventory manually took eight hours and five minutes using a computer; determining weekly purchasing needs and printing purchase orders manually required eight hours and one hour using a computer; and printing weekly physical inventory sheets took four hours manually and five minutes with a computer. Usage, price comparison, and cost per serving reports were generated in five minutes each by a computer.

METHODOLOGY

Study Site

The study was conducted in the Department of Dietetics in Geary Community Hospital, Junction City, Kansas, a 90-bed secondary care facility. The department provides food for hospital patients and offers cafeteria service to visitors, employees of both the hospital and adjacent medical arts center, and students from a community college who are working at the hospital. An average of 5,991 meals per month were served in 1988.

The department is responsible for an inventory of approximately 500 food and nonfood items. Inventory items are categorized as bread, dairy, produce, central purchasing stores (stores), pantry, miscellaneous, and freezer.

Inventory Recording System

Currently, all inventory functions are performed manually. A Veri-visible cardex system is used for recording inventory information. Illustrations of the system are contained in Appendix A.

Information for each inventory item is recorded on two pullout cards which are filed together in the cardex. These two cards will be referred to as inventory record and purchase history cards. Appendix B contains illustrations of these cards.

The name and description of each inventory item are written in the "DESCRIPTION" section of the inventory record card. The item

name is also written on the upper, slanted, right portion of the card to aid in locating the card when it is filed in the cardex. Additional information recorded on the inventory record card includes: expedite point (minimum economic buy quantity), review point (inventory level when an order should be placed), date of transaction, amount issued or received, month-to-date usage, and balance on hand after each transaction.

The name and a description of the item are also written in the "DESCRIPTION" section of the purchase history card. The review point, minimum economic buy quantity, and unit of purchase information are written on the upper right portion of the card. Data on monthly usage and inventory on hand are recorded in the "USAGE" section. Vendor name and item number, if appropriate, are written on the "VENDOR" section. Purchasing information recorded in the "PURCHASE HISTORY" section includes date of receipt, vendor from whom item was received, and purchase price.

Perpetual Inventory

A perpetual inventory is maintained for freezer and storeroom items. The assistant director is responsible for recording receipts and issues to update perpetual inventory information.

Posting Receipts. Receipt information posted from vendor invoices to the inventory card includes date of receipt and quantity received. The balance on hand is adjusted to reflect the receipt.

If the previously recorded purchase price differs from the current price, then date of receipt, vendor, and new purchase price are also recorded on the purchase history card.

Posting Issues. The advance freezer withdrawal, freezer issue, and storeroom issue sheets provide information on inventory items which have been issued for use. Issue information recorded on the inventory record card includes date of issue and quantity issued. Month-to-date usage and balance on hand after issue are then calculated. Quantity received is circled to differentiate it from the quantity issued since both are recorded in the same column.

Physical Inventory

A physical inventory is completed monthly by two individuals, the assistant director and either the foodservice supervisor or the director of the department. Results of the monthly physical inventory are used for determining inventory usage, valuing inventory, completing monthly financial reports, and reconciling perpetual inventory.

Recording Physical Inventory. Preprinted physical inventory checklists are used for recording quantity on hand for bread, dairy, produce, stores, pantry, and miscellaneous items (Appendix C). Inventory information from these forms is then transferred to the cardex. The amount on hand of freezer and storeroom items is recorded directly on the inventory record card in the cardex during

the physical inventory process. The quantity on hand for soda items is recorded on the miscellaneous form.

Physical inventory information recorded on the record card includes inventory date, and quantity on hand. If a discrepancy is observed between the physical and perpetual inventory, month-to-date usage and receipt/issue information are adjusted to reflect the physical inventory information.

Physical inventory information is written in ink to differentiate it from perpetual inventory information which is written in pencil. Also, "INV" is written on the "REF." section of the inventory record card to easily identify physical inventory information.

Costing Physical Inventory. The assistant director is responsible for calculating the cost of the physical inventory. The cost of each inventory item is calculated by first converting price per purchase unit to price per inventory unit; then the quantity on hand is multiplied by the price per inventory unit. The First-In-First-Out method is used to value inventory.

Information for inventory costing is collected from two sources: the cardex and the pantry inventory checklist. For cardex items, the cost and month-to-date usage of each inventory item are recorded on the "USAGE" section of the purchase history card (Appendix B). For pantry items, cost of each inventory item is recorded on the pantry inventory checklist. Total cost of physical inventory is computed by adding costs of individual items from both the cardex and pantry inventory.

Development of Inventory Activity Statements

The initial phase of this study involved identification of activities performed in maintaining and controlling inventory. A preliminary list of 19 inventory activity statements (Appendix D) was compiled after review of several sources: Geary Community Hospital Dietary Policy and Procedure Manual (50), Dictionary of Occupational Titles (51), Spears and Vaden (24), Pellegrino (21), West and Wood (52), Goodwin and Weinstein (53), and Andrews (12, 13). A research committee reviewed the list and recommended deletion of activity statements 4-7, 10, and 16-19 because of their more specific relationship to receiving, storage, distribution, or production. Statement 13 also was eliminated from the preliminary list because it was performed only once a year. The nine remaining activity statements were then grouped by the two inventory types: perpetual and physical (Appendix E).

The actual procedures performed at the study site were reviewed. Several activity statements were added to reflect work at the study site. Four statements related to perpetual inventory were added: recording date of transaction, calculating and recording balance on hand, calculating month-to-date usage, and labeling new inventory cards when needed.

The activity statements related to physical inventory were deemed too general and were revised to reflect specific activities at the study site. This revision resulted in the creation of 11

activity statements for physical inventory: walking to various storage areas, organizing storage areas, cleaning of storage areas, counting and recording inventory items on forms, counting and recording inventory items directly in the cardex, transferring inventory count from form to cardex, reconciling perpetual to physical inventory information, calculating and recording month-to-date usage, transferring month-to-date usage from inventory record to purchase history card, calculating cost of inventory items, and adding costs of inventory items. One additional activity statement, time spent preparing new inventory cards, was added to both perpetual and physical inventory.

Appendix F contains the list of the 21 inventory activity statements which were formulated for this study. Perpetual inventory included nine statements and physical inventory 12 statements.

Development of Observation Forms

During development of observation forms for data collection, it became apparent that several of the inventory activities were performed sequentially at the study site. Attempts to time them separately would be difficult. To facilitate timing, observation forms were then developed to reflect actual inventory procedures at the study site.

Operationally, perpetual inventory was subdivided into two sections, posting of receipts and issues. Components for each section were identified (e.g., dairy receipts, soda receipts, stores receipts, etc.). Physical inventory also was subdivided into

recording and costing sections. The inventory activities which were performed for each of the components were identified. Appendix G contains the perpetual and physical inventory components with their corresponding activity statements.

Two observation forms were developed for recording information about the specific inventory components. A pilot study was conducted to test the observation and recording procedures, and evaluate the forms for completeness and accuracy. Time spent was recorded for one week of perpetual inventory and one physical inventory. Data in the pilot study included time spent arranging invoices or forms, getting inventory cards ready for updating receipt information, and putting the cardex away. The decision was made that time spent on these "start-up" and "finish-up" tasks would not be included in the actual study.

Based on results of the pilot study, the format of the observation forms was revised slightly. All perpetual inventory components were listed on one form, labeled as category A. All physical inventory components were placed on a separate form labeled as category B for recording and C for costing. Copies of the final observation forms are contained in Appendix H.

Date of observation was entered on the top of each form. Both forms were divided into six columns. The inventory components to be timed were listed in the first column; actual time spent performing activities for that component was entered in the second; number of postings or inventory items was recorded in the third; number of documents (vendor invoices, inventory cards, or issue sheets) from

which the inventory items were taken was recorded in the fourth; and number of people working together on the inventory component was recorded in the fifth. A sixth column for "REMARKS" was used to document information which might be helpful for analyzing results.

Due to similarity of format, the two forms were color coded. The form for recording perpetual inventory was printed on pink paper and the one for physical inventory on green.

Equipment

A Delta Impex Sports Quartz Timer was used to time inventory components. An illustration of the timing device is in Appendix I. Three buttons, labeled A, B, and C, on the timer performed the timing functions. Pressing button A changed the time from normal watch to chronograph setting in which the stopwatch displayed time in minutes, seconds, and one hundredths of a second. When time exceeded 29 minutes, 59 seconds, and ninety-nine hundredths of a second, the display changed its format to hours, minutes, and seconds.

Button B was used to start and stop the time function. This feature allowed timing to be stopped when interruptions occurred, thus only time spent actually performing the inventory activities was recorded. Button C reset the stopwatch to zero and was used prior to timing each inventory activity.

Data Collection

Data were collected for the July and August inventory periods. Three physical inventories and eight weeks of perpetual inventory

maintenance occurred during the data collection period. Inventory activities were performed, timed, and documented on the observation forms by the researcher. Each form contained observations of activities which occurred on a single day; all inventory components on each form were not performed each day.

Data Analysis

Programs and routines in the Statistical Analysis System (SAS) (54) were used for all data analysis. Prior to data analysis, data for seven of the vendors (Cruce, Foodservices of America, Lady Baltimore, Manhattan Wholesale, Moccomat, Shared Service Systems, and other vendors) listed separately on the perpetual inventory observation form were combined into one component called other vendors. Initial analysis included computation of frequencies for all variables. Data were then sorted by month prior to computing total and mean times.

RESULTS AND DISCUSSION

Perpetual Inventory

Time Spent

Data were collected on time spent posting receipts and issues for perpetual inventory. Table 1 presents the results of time spent by month posting receipts and issues.

Posting Receipts. The majority of time spent posting receipts was for the other vendors component (5.41 hours). These results are not surprising as the other vendors component contains data from seven vendors. A total of 6.83 hours was spent during the two month period posting receipts with slightly more time spent in July than in August.

Posting Issues. Posting storeroom issues required the greatest time (4.52 hours). More time was spent during the two month period posting issues (9.21 hours) than posting receipts. Slightly more time was spent posting issues in July than in August.

Total. Approximately 16 hours were spent posting receipts and issues for perpetual inventory in July and August. Performing perpetual inventory in July took more time than in August, which is not unexpected because posting receipts and issues each required more time in July.

Table 1. Time spent posting perpetual inventory by month

perpetual inventory sections and component	July		August		total		
	N	time	N	time	N	time	
posting receipts	(days)	(seconds)	(days)	(seconds)	(days)	(seconds)	(hours)
. dairy	9	2,268	7	1,256	16	3,524	0.98
. soda	2	79	1	41	3	120	0.03
. other vendors	8	10,417	9	9,067	17	19,484	5.41
. stores	4	713	4	747	8	1,460	0.41
total		13,477		11,111		24,588	6.83
posting issues							
. advance freezer	11	1,909	9	1,467	20	3,376	0.94
. freezer	9	7,226	8	6,285	17	13,511	3.75
. storeroom	11	9,458	8	6,823	19	16,281	4.52
total		18,593		14,575		33,168	9.21
total for perpetual inventory		32,070		25,686		57,756	16.04

[a]N = number of days data gathered

Number of Postings

Data were collected on the number of receipts and issues posted for perpetual inventory. Table 2 presents information on number of postings for perpetual inventory by month.

Posting receipts. The greatest number of receipts posted was for the other vendors component (740). Considerably more time was spent on this component as well (Table 1). Although the results were similar for July and August, slightly more receipts were posted in July.

Posting issues. Number of issues posted were almost twice (1,712) the number of receipts posted (993). The higher number of issues posted might explain the greater time spent in posting issues than in posting receipts (Table 1). More issues were posted in July (915) than in August (797).

Total. A total of 2,705 receipt and issue postings were completed for perpetual inventory during the two month period. Results were similar for number of postings in July and August with the number of postings slightly higher in July.

Mean Time for Perpetual Inventory Components

Mean time per inventory posting was calculated by dividing time spent (Table 1) by the number of postings (Table 2). Results of this calculation are presented in Table 3.

Table 2. Number of postings for perpetual inventory by month

perpetual inventory sections and components	July		August		total	
	N[a]	number of postings	N	number of postings	N	number of postings
posting receipts						
. dairy	9	95	7	71	16	166
. soda	2	5	1	3	3	8
. other vendors	8	381	9	359	17	740
. stores	4	42	4	37	8	79
total		523		470		993
posting issues						
. advance freezer	11	93	9	72	20	165
. freezer	9	275	8	289	17	564
. storeroom	11	547	8	436	19	983
total		915		797		1,712
total for perpetual inventory		1,438		1,267		2,705

[a]N = number of days data gathered

Table 3. Mean time per inventory posting[a] for perpetual inventory by month

perpetual inventory sections and components	July mean	July std dev	August mean	August std dev	total mean	total std dev
posting receipts	←----------time (seconds)----------→					
. dairy	23.75 ± 3.81		18.52 ± 6.14		21.46 ± 5.48	
. soda	15.42 ± 2.71		13.67 ± 0.00		14.83 ± 2.16	
. other vendors	26.58 ± 4.00		25.10 ± 2.39		25.00 ± 3.23	
. stores	16.17 ± 3.77		19.58 ± 4.53		17.88 ± 4.27	
total	25.10 ± 2.74		23.27 ± 2.27		24.18 ± 2.62	
posting issues						
. advance freezer	20.63 ± 3.57		20.06 ± 3.91		20.37 ± 3.64	
. freezer	25.95 ± 3.67		21.86 ± 2.18		24.02 ± 3.64	
. storeroom	17.18 ± 2.48		15.50 ± 1.88		16.47 ± 2.35	
total	20.06 ± 2.42		18.51 ± 1.83		19.36 ± 2.26	
total for perpetual inventory	22.62 ± 1.25		20.25 ± 1.26		21.50 ± 1.72	

[a]mean time per inventory posting = time spent on inventory component divided by number of postings.
Refer to table 1 for total time spent and Table 2 for number of postings.

Posting Receipts. Posting of receipts from other vendors required the greatest time spent per posting, 25.80 seconds; posting of soda receipts required the least mean time posting receipts, 14.83 seconds. These results may be related to the ease in locating inventory cards in the cardex. Posting the other vendors component required locating approximately 450 inventory cards, which were filed throughout the cardex; posting receipts for the soda component required locating only four inventory cards which were filed together in the cardex.

Also, inventory cards requiring price variance checks required greater mean posting time (e.g. price variance checks are completed for dairy, and other vendor components, but not for the stores component). The impact of time required to do price variance checks is evident in the dairy component. The time for posting dairy receipts was noticeably less in August than in July. Dairy items were purchased on bid in August with a guaranteed price, thus price variance checks were not completed. Little variation in mean time posting receipts was noted by month.

Posting Issues. Posting of storeroom issues required less time per posting (16.47 seconds) than posting issues from either the freezer (24.02 seconds) or advance freezer withdrawals (20.37 seconds). Inventory cards for the storeroom component were easier to locate because the cards were filed under food type headings arranged alphabetically. Inventory cards for the freezer component

were filed by freezer location, not alphabetically, which made locating the cards more difficult. The mean times for posting issues were similar for July and August.

Total. The mean time for posting receipts and issues for perpetual inventory did not vary much for July and August. Posting a receipt or issue took an average of 21.50 seconds during the two month period.

Number of Documents

A document was defined as any piece of paper from which receipt or issue information was taken. Each vendor invoice was counted as one document for posting receipts. Documents for posting issues included: advance freezer withdrawal, freezer issue, and storeroom issue sheets.

Number of People

Data on number of people involved at one time in posting receipts and issues were collected. Only one person performed the activities for each of the perpetual inventory components.

Physical Inventory

Time Spent

Data on time spent recording and costing physical inventory items were collected. Table 4 presents this information by month.

Table 4. Time spent performing physical inventory by month[a]

physical inventory sections and components	June	July	August	total time (seconds)	total time (hours)
recording	←--time (seconds)--→				
bread					
. form[b]	166	186	256	608	0.17
. cardex[c]	127	119	105	351	0.10
dairy					
. form	325	287	365	977	0.27
. cardex	642	434	335	1,411	0.39
produce					
. form	209	200	257	666	0.18
. cardex	315	361	434	1,110	0.31
stores					
. form	392	404	316	1,112	0.31
. cardex	489	512	375	1,376	0.38
pantry					
. form	799	547	468	1,814	0.50
. cardex	0	0	0	0	0.00

[a] physical inventory taken one day per month
[b] entering physical inventory on forms
[c] entering physical inventory in cardex
[d] refer to Appendix C for preprinted miscellaneous form
[e] time reflects total time for two people

Table 4. (cont.)

physical inventory sections and components	June	July	August	total time	
recording (cont.)	←--time (seconds)--→			(seconds)	(hours)
miscellaneous[d]					
. form	307	555	432	1,294	0.36
. cardex	778	640	700	2,118	0.59
freezer[e]					
. form	0	0	0	0	0.00
. cardex	12,718	11,444	13,116	37,278	10.35
storeroom[e]					
. form	0	0	0	0	0.00
. cardex	4,966	5,470	5,134	15,570	4.32
total	22,233	21,159	22,293	65,685	18.25
costing					
cardex	8,560	7,808	7,340	23,708	6.58
pantry	1,443	992	1,255	3,690	1.03
adding cardex and pantry item costs	1,953	1,707	1,740	5,400	1.50
total	11,956	10,507	10,335	32,798	9.11
total for physical inventory	34,189	31,666	32,628	98,483	27.36

Recording. Recording of the physical inventory component was completed in one of three ways: the quantity of inventory on hand was entered on a preprinted inventory form only, the amount of inventory on hand was entered directly in the cardex, or the amount of inventory on hand was entered on a preprinted inventory form and then transferred to the cardex. Results of time spent recording physical inventory components are categorized in Table 4 as time spent recording on inventory forms (form) and in the cardex (cardex).

The freezer was the physical inventory component which involved the greatest time (10.35 hours). The quantity of inventory on hand for the freezer component was entered directly in the cardex. Two factors probably contributed to greater time being spent on the freezer. First, the recording was performed by two employees; the time spent includes the time of both employees. Second, physical inventory of the freezer involved the activities of cleaning and organizing the freezer. Recording of storeroom items also was performed by two employees; however, less time was spent on this component than on the freezer because cleaning and organizing the storeroom did not occur concurrently with inventory recording.

Although recording of physical inventory for bread, dairy, produce, stores, and miscellaneous components required entering information on an inventory form and then transferring this information to the cardex, the total time spent on these components was less than an hour each month. Recording the quantity on hand on an inventory form required less time than transferring the same

information to the cardex for all components except bread. Recording quantity of inventory on hand for bread items involved organizing storage shelves, thus requiring more time. Little variation in time spent recording physical inventory was noted by month.

Costing. Costing of physical inventory required about half as much time (9.11 hours) as did recording (18.25 hours) possibly because recording of physical inventory involved more activities than costing (Appendix G). Time spent costing physical inventory was similar each month although time spent in June was slightly higher than in July and August.

Total. Total time spent recording and costing physical inventory varied little each month. Approximately 27 hours were used to complete the three physical inventories.

Number of Physical Inventory Items Recorded and Costed

Table 5 presents number of physical inventory items recorded and costed by month. As in Table 4, results are categorized under each component as number of items per form and cardex.

Recording. The majority of inventory items recorded (690) were from the storeroom component and were recorded directly in the cardex. The second greatest number of items were in the freezer component which also were recorded directly in the cardex (344).

Several components required entering quantity of inventory on hand on an inventory form and then transferring this information

Table 5.[a] Number of physical inventory items recorded and costed by month

physical inventory sections and components	June	July	August	total
recording	←----------number of items----------→			
bread				
. form[b]	18	13	14	45
. cardex[c]	12	12	12	36
dairy				
. form	30	28	26	84
. cardex	26	25	26	77
produce				
. form	31	31	32	94
. cardex	31	30	33	94
stores				
. form	52	52	52	156
. cardex	46	45	45	136
pantry				
. form	125	100	102	327
. cardex	0	0	0	0

[a] physical inventory taken one day per month

[b] entering physical inventory on forms

[c] entering physical inventory in cardex

[d] time reflects total time for two people

[e] inventory items which had no quantity on hand were not included when adding cardex and pantry items

Table 5. (cont.)

physical inventory sections and components	June	July	August	total
recording (cont.)	<----------number of items---------->			
miscellaneous				
. form	49	49	50	148
. cardex	48	47	50	145
freezer[d]				
. form	0	0	0	0
. cardex	114	115	115	344
storeroom[d]				
. form	0	0	0	0
. cardex	230	230	230	690
total	812	777	787	2,376
costing				
cardex	506	508	508	1,522
pantry	108	95	102	305
adding cardex and pantry item costs[e]	579	562	557	1,698
total	1,193	1,165	1,167	3,525
total for physical inventory	2,005	1,942	1,954	5,901

to the cardex (i.e. bread, dairy, produce, stores, and miscellaneous). The number of items recorded on the form for some of these components is often more than the number of items recorded in cardex because several inventory cards contain more than one inventory item. For example, when recording on the form, white and wheat croissants were listed as two inventory items and were counted as two recordings. When transferring information on white and wheat croissants to the cardex, both were listed on the same inventory card and thus were counted as one inventory item.

Costing. A total of 1,827 inventory items were costed from the cardex and pantry; 1,522 inventory items were costed in the cardex and 305 in the pantry. The number of items which were included in the adding of the cardex and pantry was somewhat less (1,698), however, because some inventory items had a physical inventory count of zero and were not included. Little variation was noted on number of inventory items costed each month.

Total. The total number of physical inventory items recorded and costed were slightly more in June (2,005) than July (1,912) or August (1,954). A total of 5,901 physical inventory items were recorded and costed for the three physical inventories completed.

Mean Time Spent for Physical Inventory Components

Mean time per inventory item was calculated by dividing time spent (Table 4) by the number of inventory items (Table 5).

Table 6 reports mean time per inventory item for recording and costing physical inventory.

Recording. The pantry components required the least time per item to record (5.48 seconds). The majority of inventory items in the pantry component were accessible and, therefore, may have required less time to count than did inventory items in the other components. Pantry items also were recorded only on an inventory form and not transferred to cardex. More time was spent for components which required organizing storage location before counting could be done (e.g. bread, dairy, stores).

Recording storeroom and freezer inventory directly in the cardex required the greatest mean time per item, 22.56 seconds for storeroom and 108.38 seconds for freezer. Both of these components were performed by two employees. Recording of freezer inventory also included time spent cleaning and organizing the freezer and also, pulling racks in and out of the freezer, which probably contributed to the greater amount of time spent per item.

Mean time recording physical inventory items was less in July (21.94 seconds) than in June (30.56 seconds) or August (29.16 seconds). One possible explanation may be that less time was spent on the freezer inventory in July than in June or August.

Costing. Costing of cardex items required more time (15.58 seconds) than for pantry items (12.04 seconds), possibly because costing of cardex items involved more activities than pantry

Table 6. Mean time per inventory item[a] for physical inventory by month

physical inventory sections and components	June	July	August	total mean	total std dev
	←-------mean---------→				
recording	←----------time (seconds)----------→				
bread					
. form[c]	9.22	14.31	18.29	13.94 ±	4.54
. cardex[d]	10.58	9.92	8.75	9.75 ±	.93
dairy					
. form	10.83	10.25	14.04	11.71 ±	2.04
. cardex	24.69	17.36	12.88	18.31 ±	5.96
produce					
. form	6.74	6.45	8.03	7.07 ±	.84
. cardex	10.16	12.03	13.15	11.78 ±	1.51
stores					
. form	7.54	7.77	6.08	7.13 ±	.92
. cardex	10.63	11.38	8.33	10.11 ±	1.59
pantry					
. form	6.39	5.47	4.59	5.48 ±	.90
. cardex	0.00	0.00	0.00	0.00	

[a] mean time per inventory item = time spent divided by number of items recorded.

[b] physical inventory taken one day per month

[c] entering physical inventory on form

[d] entering physical inventory in cardex

[e] time reflects total time for two people

Table 6. (cont.)

physical inventory sections and components	June	July	August	total mean	total std dev
	←mean→				
recording (cont.)	←time (seconds)→				
miscellaneous					
. form	6.27	11.24	8.64	8.72 ±	2.49
. cardex	16.21	13.62	14.00	14.61 ±	1.40
freezer[e]					
. form	0.00	0.00	0.00	0.00	
. cardex	111.56	99.51	114.05	108.38 ±	7.78
storeroom[e]					
. form	0.00	0.00	0.00	0.00	
. cardex	21.59	23.78	22.32	22.56 ±	1.12
total	30.56	21.94	29.16	27.22 ±	19.54
costing					
cardex	16.92	15.37	14.45	15.58 ±	1.25
pantry	13.36	10.44	12.30	12.04 ±	1.48
adding cardex and pantry item costs	3.37	3.04	3.12	3.18 ±	.17
total	10.93	9.02	8.86	9.93 ±	5.02
total for physical inventory	20.75	17.63	22.39	20.31 ±	17.33

items (Appendix G). Adding cardex and pantry item costs required only 3.18 mean seconds per item. Mean time costing physical inventory was similar by month although mean time for June was slightly higher.

Total. Total mean time recording and costing physical inventory was similar for June, July, and August; mean time, however, for July was slightly less. Recording and costing of physical inventory took approximately 20 seconds per item.

Number of Documents

The preprinted inventory form and card were counted as one document during data collection for recording and costing physical inventory. Information on the number of documents was recorded during data collection. A determination was made that number of postings more clearly reflected the inventory process, thus information on number of documents was not used for further data analysis.

Number of People

Information on number of people performing the physical inventory components was collected. One person performed each of the physical inventory components except for recording quantity of inventory on hand for freezer and storeroom components, which were performed by two people.

Time Spent Manually Performing Perpetual and Physical Inventory

Total Time

Table 7 in Appendix J reports the total time spent performing perpetual and physical inventory by month. A total of 16 hours was spent performing perpetual inventory activities spent during the two month period. Spears and Vaden (24) contended maintaining perpetual inventory takes time and suggested its use only in large operations with large inventories.

The results of this study revealed that considerably more time was spent performing physical than perpetual inventory. A total of 27.36 hours was spent completing three physical inventories for the same two month period.

Average Time

Average hours spent per month performing perpetual inventory activities was calculated by dividing total hours (Table 7 in Appendix J) by two since perpetual inventory was maintained for two months. Average hours spent per month for performing physical inventory was calculated by dividing total hours (Table 7 in Appendix J) by three since three physical inventories were completed. Average time spent performing perpetual and physical inventories are presented in Table 8 in Appendix J. Performing perpetual inventory required slightly less time per month (8.02 hours) than did performing physical inventory (9.12 hours). Mayfield (49) reported valuing monthly inventory took eight hours manually.

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary

The healthcare industry, faced with increased demand to cut cost, has begun using computers to help control inventory. Tuthill (6), Schwartz (1B), Andrews (19), and Aldrich and Helbig (20) recognized the importance of a good manual system for inventory control prior to computerization. Pellegrino (21) recommended comparing cost of manual and computerized systems to evaluate economic feasibility of computerization. The purpose of this study was to measure time spent manually performing foodservice inventory activities in a small community hospital. Specific objectives of the study were to compile a list of activities performed by foodservice personnel to maintain inventory and determine actual time spent performing perpetual and physical inventory activities manually.

The study was conducted in the Dietary Department of Geary Community Hospital, a 90-bed secondary care facility. The initial phase of the study involved identification of activities performed in maintaining and controlling inventory. A list of 21 inventory activity statements was compiled: nine for perpetual and 12 for physical inventory.

The second phase of the study focused on development of observation forms to collect data on operational practices at the study site. Because several inventory activities occurred sequentially

and would be difficult to time, observation forms were developed to reflect actual inventory practices at the study site. Inventory components, which consisted of several activities, were identified. Perpetual inventory components were grouped into posting receipt and issue sections, and physical inventory components were grouped into recording and costing sections to facilitate data collection. Two observation forms were developed, one which listed the inventory components for perpetual inventory and the other the components for physical inventory.

Data were collected for a two-month period, July and August. Three physical inventories and eight weeks of perpetual inventory maintenance occurred during the data collection period. Perpetual and physical inventory components were performed, timed and documented by the researcher.

Data on time spent, number of postings or inventory items, number of documents, and number of persons working together were recorded for both perpetual and physical inventory components. Mean time per posting or inventory item was calculated by dividing time spent by the number of postings or inventory items.

Time spent posting issues for perpetual inventory (9.21 hours) was greater than time spent posting receipts (6.83 hours). More postings were completed for issues (1,712) than for receipts (993). Less time was spent per posting when inventory cards were easy to locate, and price variance was not checked. Ease in locating items was related to the number of cards per inventory component and the order in which cards are filed in the cardex.

Time spent recording physical inventory (18.25 hours) was twice the time spent costing physical inventory (9.11 hours). A total of 2,376 and 3,525 physical inventory items was recorded and costed, respectively. Recording freezer inventory components required the greatest mean time per item (108.38 seconds) because this component was performed by two persons. Recording freezer inventory components also involved cleaning and organizing the freezer and pulling racks in and out of the freezer. Less time was spent recording on the form than transferring information from the form to the cardex for physical inventory components which required both recording on a form and in the cardex. Costing of cardex items required more time per inventory item (15.58 seconds) than did costing of pantry items (12.04 seconds).

Approximately 43 hours was spent in a two-month period performing perpetual and physical inventory activities manually: maintaining perpetual inventory required 16.04 hours and completing three physical inventories required 27.36 hours. An average of eight hours per month was spent performing perpetual inventory and nine hours for physical inventory.

Conclusion and Recommendations

The results of this study will provide Geary Community Hospital with data on time spent manually performing inventory activities. Having these data will enable the director of dietetics to determine the cost of manually maintaining inventory and compare it with

computerizing these activities. The study results may also provide information for review of job descriptions.

Results of this study indicated that less time was spent performing inventory components when inventory cards were easy to locate and when price variance checks were not needed. Labor time might be reduced if inventory cards were rearranged in the cardex to facilitate ease in locating them and if price variance checks could be performed less frequently.

Additional research is needed on time spent maintaining inventories for hospitals of varying sizes to determine if a significant relationship exists between hospital size and time spent maintaining inventory. Further research comparing costs of manually performing inventory activities with those of computerized inventory systems would provide valuable information.

Inventory activities in this study were performed, timed, and recorded by the researcher. With modification of activity statements and observations forms, the procedure of timing used in this study could be adapted to other foodservice operations.

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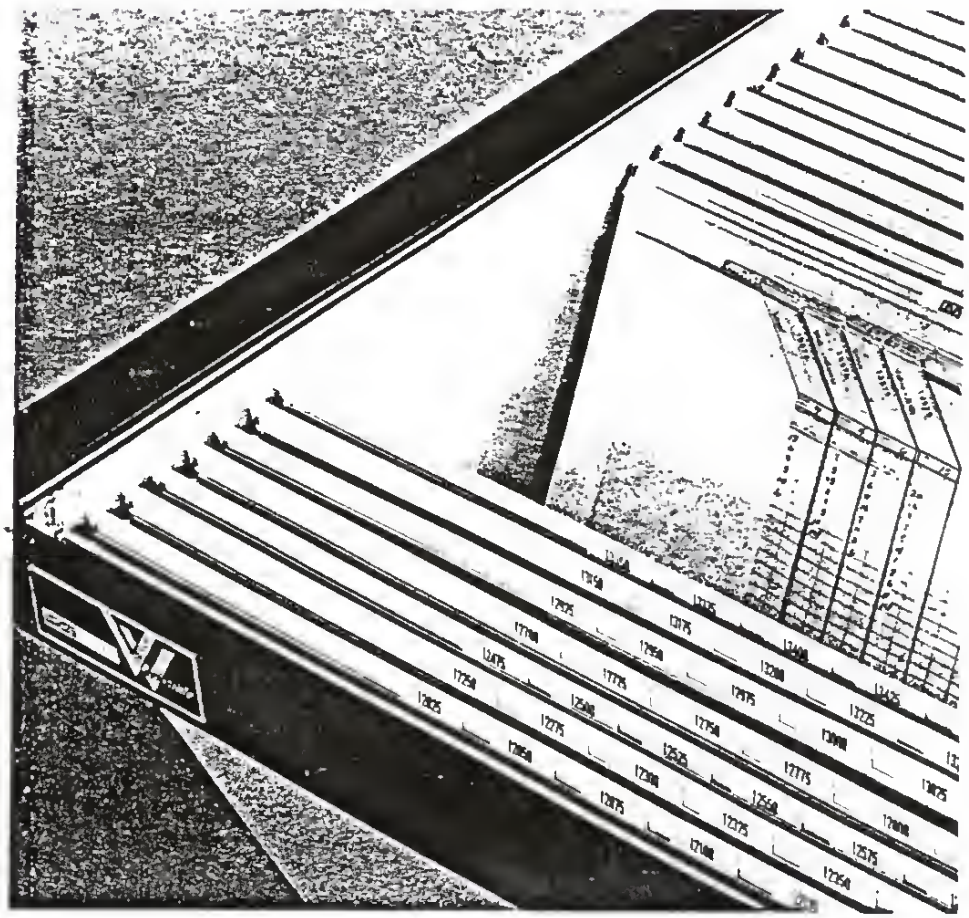
APPENDIXES

APPENDIX A

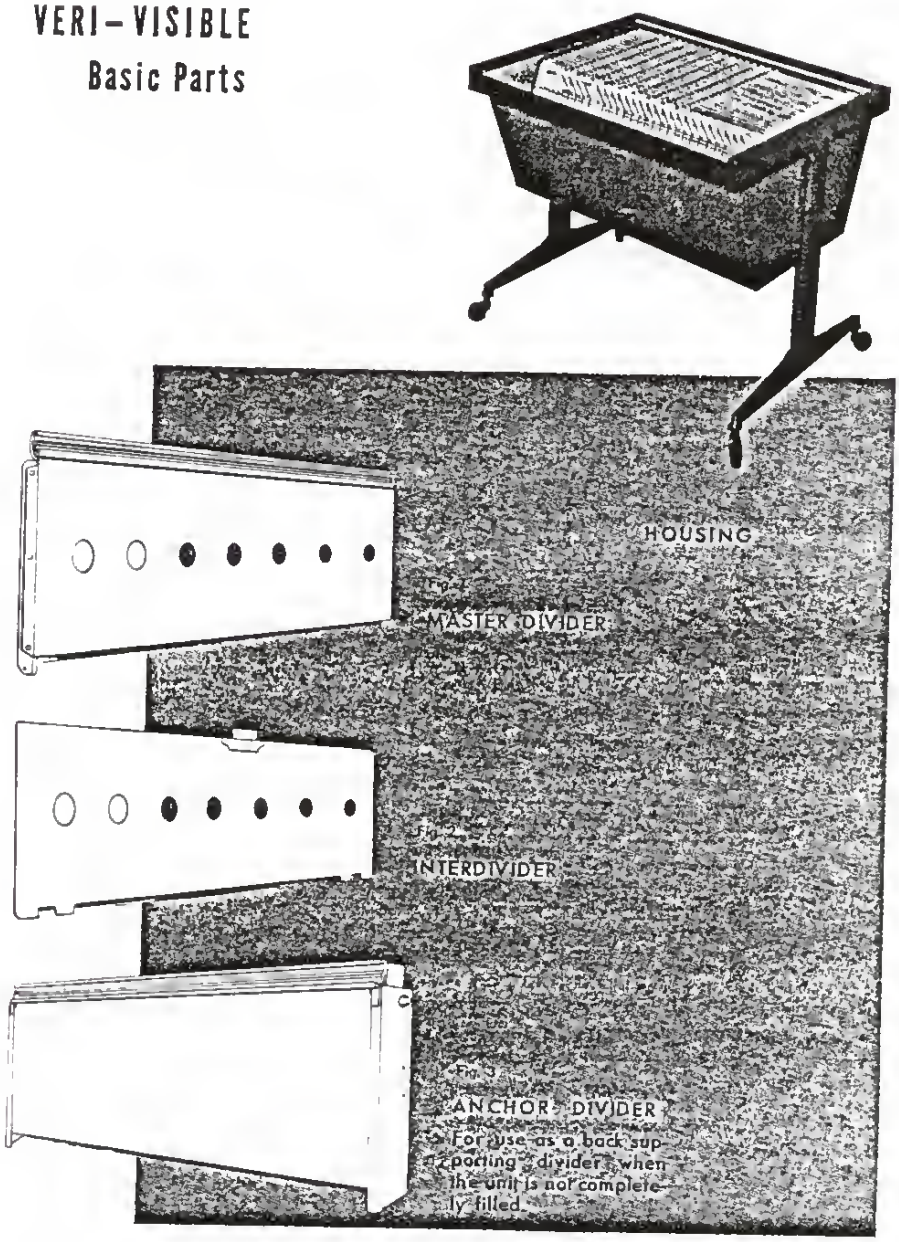
Illustrations of Inventory Recording System

ACME VISIBLE

Veri-Visible®

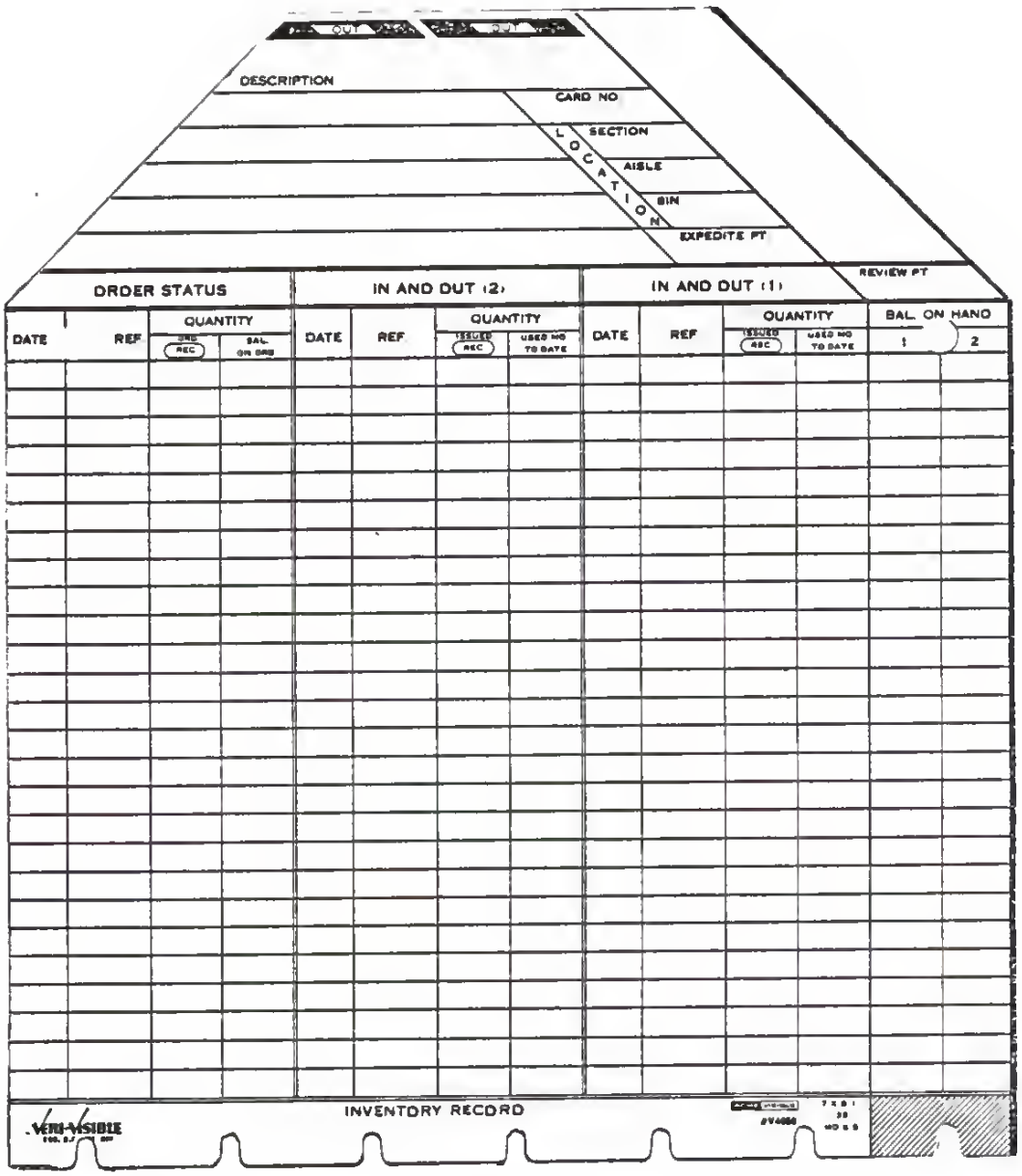


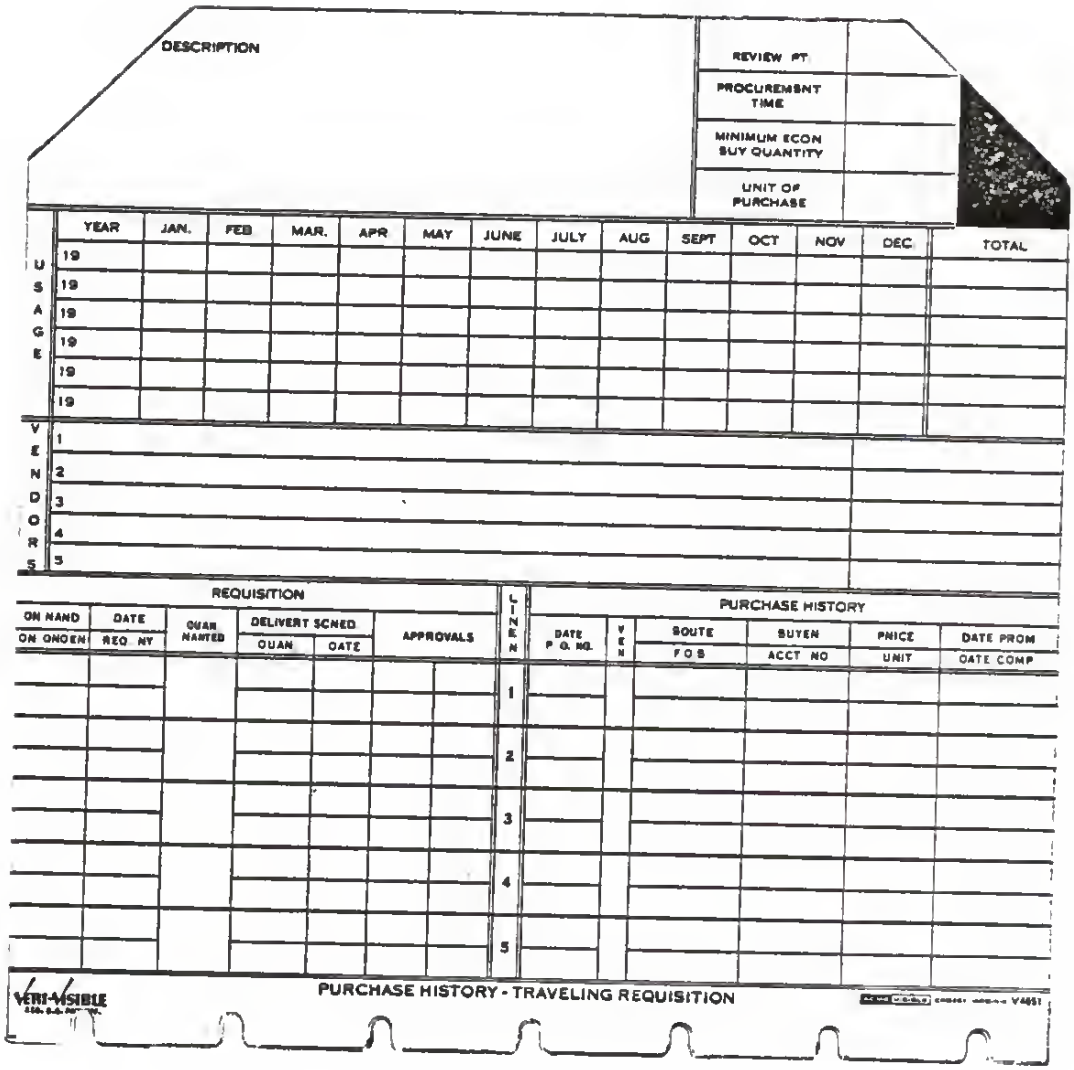
VERI-VISIBLE
Basic Parts



APPENDIX B

Illustrations of Inventory Cards


DESCRIPTION
CARD NO
LOCATION
SECTION
AISLE
BIN
EXPEDITE PT
REVIEW PT
ORDER STATUS
IN AND OUT (2)
IN AND OUT (1)
DATE
REF
QUANTITY
BAL ON HAND
USED NO TO DATE
INVENTORY RECORD
VERI-VISIBLE


DESCRIPTION
REVIEW PT
PROCUREMSNT TIME
MINIMUM ECON SUY QUANTITY
UNIT OF PURCHASE
USAGE
YEAR
JAN.
FEB
MAR.
APR
MAY
JUNE
JULY
AUG
SEPT
OCT
NOV
DEC
TOTAL
19
VENDORS
1
2
3
4
5
REQUISITION
ON HAND
ON ORDER
DATE REQ NY
QUAN WANTED
DELIVERY SCHED
QUAN
DATE
APPROVALS
LINE N
PURCHASE HISTORY
DATE P O NO
VEN
ROUTE
F O B
BUYER
ACCT NO
PRICE
UNIT
DATE PROM
DATE COMP
VERI-VISIBLE
PURCHASE HISTORY - TRAVELING REQUISITION

APPENDIX C

Preprinted Physical Inventory Forms

BREAD CHECKLIST: DATE:

I T E M	INVENTORY PANTRY	INVENTORY FREEZER	W O R K S H E E T
WHITE BREAD, 24 sl/loaf			
WHOLE WHEAT BREAD, 24 sl/loaf			
SF BREAD, 16 sl/loaf			
HAMBURGER BUNS, WHITE, 12/pkg			
HAMBURGER BUNS, WHEAT, 12/pkg			
HOTDOG BUNS, 12/pkg			
SUBMARINE BUNS,6/pkg			
FRENCH BREAD, 14svg/loaf			
TEXAS TOAST, 13 sl/loaf			
ENGLISH MUFFINS, 12/pkg			
LIGHT RYE BREAD, 14 sl/loaf			
DARK RYE BREAD, 14 sl/loaf			
CROISSANT, WHITE, 4/pkg			
CROISSANT, WHOLE WHEAT, 4/pkg			

DAIRY CHECKLIST DATE:

ITEM	SPEC.	REVIEW POINT	MIN. ECON. BUY (QUANTITY)*	AMOUNT ON HAND	AMOUNT TO ORDE
VANILLA ICE CREAM	2 doz/4 oz pk	2 doz	2 doz		
STRAWBERRY " "	"	2 doz	2 doz		
CHOCOLATE " "	"	2 doz	2 doz		
LIME SHERBET	"	I doz	2 doz		
ORANGE SHERBET	"	I doz	2 doz		
PINEAPPLE SHERBET	"	I doz	2 doz		
RASPBERRY SHERBET	"	1 doz	2 doz		
POPSICLE	2 doz/box	1 doz	1 bx		
COTTAGE CHEESE	5# cont	2/5# cont	2/5# cont		
SOUR CREAM, INO.	200/1oz/cs	1/4 cs	I cs		
SOUR CREAM	5# cont	5# cont	2/5# cont		
OLEO REODIES	(1080 ct) 12# cs	1/4 cs	I cs		
OLEO SOLIOS	30/1#/cs	20#	1 cs		
ORANGE JUICE	gallon	IO gal on hand	by the gallon		
ASSORTED YOGURT	I2/8oz/cs	2 doz on hand			
WHOLE MILK	50/½pt/cs	2 cs	2 cs		
SKIM MILK	50/½pt/cs	I cs	I cs		
CHOCOLATE MILK	50/½pt/cs	IS units	2S units		
2% MILK	9/½gal/cs	2 cs	2 cs		
BUTTERMILK	1 qt	1 qt on hand	qt		
HALF AND HALF	1 pint	1 pt on hand	pt		
DRUMSTICK	2 doz/box	I/2 doz	1 box		
ESKIMO PIE	"	1 doz	1 box		
FUDGESICLE	"	1 doz	1 box		
HEATH BARS	"	1 doz	1 box		
ICE CREAM SAND	"	2 doz	1 box		

*MAY VARY ACCORDING TO PATIENT COUNT AND SEASON OF THE YEAR

PRODUCE CHECKLIST

I T E M	UNIT OF PURCH.	REVIEW POINT	MINIMUM ECONOMY BUY	AMOUNT ON HAND	AMOUNT TO ORDE
CABBAGE, GREEN	10#	AS NEEDED	10#		
CARROTS, BULK, JUMBO	25#	5#	25#		
CELERY	6 ct	6	6		
CUCUMBER	5#	5#	5#		
GREEN PEPPERS	5#	5#	5#		
LEMONS	24 ct	12	24 ct		
LETTUCE, HEAD	4/6 ct	12	4/6ct		
LETTUCE, LEAF	10#	½bx	10#		
PARSLEY	6 ct	4	6 ct		
ONIONS, MED.	50#	15#	50#		
POTATOES, BAKERS	100 ct	3/4cs	100 ct		
POTATOES, RUSSET	100#	50#	100#		
RADISHES, RED	4#	1#	4#		
TOMATOES, 5x6	1ug	1 1ug	2 1ug		
APPLES, RED DEL FCY,	125 ct	½bx	125 ct		
BANANAS	10#	5#	10#		
CANTALOUPE	pc	6	15		
CHERRIES	ctn	½bx	1 ctn		
GRAPES, RED, SEEDLESS	1ug	½1ug	1 1ug		
GRAPES, WHITE, SEEDLESS	1ug	½1ug	1 1ug		
GRAPEFRUIT	6 ct	2	6 ct		
ORANGES, NAVEL,	125 ct	½bx	125 ct		
NECTARINES	ctn	½bx	1 ctn		
PEACHES	ctn	½bx	1 ctn		
PEARS	ctn	½bx	1 ctn		
PLUMS	ctn	½bx	1 ctn		
STRAWBERRIES	flat	1 flat	1 flat		
WATERMELON	pc	2	2		
EGGS, GRADE A LARGE	cs	1cs	1cs		
CREAM CHEESE	3# bl	3#	3#		
SWISS CHEESE, SLICED	5#	5#	10#		
AMERICAN CHEESE SLICES	5#	5#	10#		

CENTRAL PURCHASING STORES CHECKLIST

CATALOG NUMBER	I T E M	REVIEW POINT	MINIMUM ECON. BUY (QTY.)	AMOUNT ON HAND	AMOUNT TO ORD
---	1 oz. SOUFFLE CUPS	1 box	1 box		
60-35	STRAW	1 box	1 box		
4220	DISPOSABLE NURSES CAP	½box	1box		
10204	DISPOSABLE GLOVES		2bx/week		
11288	PAN DANDY	5 gal	5 gal		
6J6	STYROFOAM CUPS 6 oz.	6 stacks	1 bx		
	*CHALKBOARD MARKERS	0	1 pc		
GCH920-06	CASH RECONCILLATION	½ pad	1 pad		
63	*CLASP ENVELOPES 6½"x9½"	1/8 bx	1 bx		
7500	HP-1 ENZYME	0	1 gal		
224	PAPER TOWELS	3 pkgs	1 cs		
	COMET	1 can	2 cans		
10439	GUARDIAN	1cs	1cs		
18929	SOILAX GLASS CLEANER	2 cans	1 cs		
MO-7	LOTION SOAP	1 carton	1 carton		
11486	ASSURE	1 gal	2 gals		
17111	GREASECUTTER	1 gal	2 gals		
12021	LIMEAWAY	2 gals	2 gals		
14639	MIKROKLENE	1 gal	1 gal		
13219	MIKROQUAT	1 gal	2 gals		
14985	RINSE DRY	2 gals	2 gals		
P37158	SMALL GARBAGE BAGS	1/8 cs	1 cs		
P22108	MEDIUM GARBAGE BAGS	1/8 cs	1 cs		
P48208	LARGE GARBAGE BAGS	1cs	1 cs		
	ADDING MACHINE TAPE	1 roll	1 roll		
	CASH REGISTER TAPE	3 rolls	1 pkg		
	CASH REGISTER RIBBON	0	1 bx		
	CORRECTION FLUID	0	1 jar		
	INDEX CARDS 3"x5"	0	1 pkg		
	INDEX CARDS 5"x7"	0	1 pkg		

*these items need to be ordered on a purchase requisition

CENTRAL PURCHASING STORES CHECKLIST (CONT'D)

CATALOG NUMBER	I T E M	REVIEW POINT	MINIMUM ECON. BUY (QTY.)	AMOUNT ON HAND	AMOUNT TO ORDI
	MASKING TAPE, 1"	2 rolls	2 rolls		
23995-IIS	ALCOHOL WIPES	½ box	1 bx		
72360	REGULAR PAPER CLIPS	0	1 bx		
72S00	JUMBO PAPER CLIPS	0	1 bx		
	THUMBTACKS	0	1 bx		
6200	SCOTCH TAPE, ½"	2 rolls	1 roll		
RW-35	STAPLE WIRES	0	1 bx		
	TYPEWRITER RIBBON for IBM SELECTRIC II	0	1 bx		
3782-L	CORRECTION TAPE	0	1 bx		
	YELLOW LEGAL PAD	2 pads	2 pads		
	BAND-AID	½ bx	1 bx		
	1"x3" WHITE LABELS	1 roll	1 roll		
GCH801-08	PATIENT DIET CARD	25 sheets	100 sheets		
GCH801-11	UNIVERSAL MENU	2 pads	4 pads		
GCH801-12	LIQUID MENU	2 pads	4 pads		
	WIDE TIP PERMANENT MARKER	1 marker	1 marker		
	FILE FOLDERS	1/8 box	1 cs		
GCH675-09	STORES REQUISITION FORM	2 sheets	10 sheets		
	SHEET PROTECTORS	AS NEEDED			
GCH801-03	CALC NUTRI. VALUE OF FOODS	1 pad	3 pads		
GCH801-01	DIET HISTORY FORMS	½ pad	3 pads		
GCH675-10	PURCHASE REQUISITION FORMS	10 sheets	20 sheets		
GCH902-01	STATUS FORMS	20 sheets	20 sheets		

PANTRY INVENTORY CHECKLIST

ITEM	AMOUNT	ITEM	AMOUNT	ITEM	AMOUNT
COFFEE		SILVERWARE BAGS			
SANKA		SANDWICH BAGS			
		FRYMAX			
HOT TEA		SALAD OIL (2)			
HOT CHOCOLATE		REGULAR KITS			
		LOW SODIUM KITS			
		DIABETIC KITS			
		ADA/NA KITS			
		BLAND KITS			
IND MAYONNAISE		IND CR MUSH SOUP			
IND MUSTARD		IND SF CR MUSH SP			
IND CATSUP		IND CR CHIX SOUP			
		IND CR TOMATO SOUP			
APPLE JUICE		IND SF CR TOM SP			
APRICOT NECTAR		IND VEG SOUP			
CRANBERRY JUICE		IND SF VEG SOUP			
GRAPE JUICE		IND CHIX NOL SP			
GRAPEFRUIT JUICE		IND SF TURK NOL SP			
PEACH NECTAR					
PEAR NECTAR		MASHED POTATOES (2)			
PINEAPPLE JUICE		BROWN GRAVY			
PRUNE JUICE		CHICKEN GRAVY			
TOMATO JUICE		SF BROWN GRAVY			
SF TOMATO JUICE		SF CHIX GRAVY			
LEMON JUICE		SALT (1.1)			
APPLESAUCE		CORNSTARCH (1.1)			
		FLOUR			
		SUGAR			
		BROWN SUGAR			
		POWDERED SUGAR			
		FOOD RELEASE			
MUSTARD, GAL		WHIPPED TOPPING			
PICKLE RELISH		FRILLY TOOTHPICK			
MARASCHINO CHERRIES		ALL BRAN			
BULK CATSUP		40% BRAN FLAKES			
ASST CRACKERS		RAISIN BRAN			
SALTINES		RICE KRISPIES			
GRAHAM CRACKERS		CORN FLAKES			
SF CRACKERS		SHREDDED WHEAT			
IND SALT PKG		CHERRY GELATIN			
IND SALT SUB PKG		LEMON GELATIN			
IND PEPPER PKG		LIME GELATIN			
IND SUGAR PKG		ORANGE GELATIN			
IND SUGAR SUB		STRAWBERRY GELATIN			
IND JELLY PKG		ALUMINUM FOIL			
IND DIET JELLY		18" FOOD FILM			
IND BEEF BROTH		12" FOOD FILM			
IND SF BEEF BROTH		POTATO WRAP			
IND CHIX BROTH		POTATO CHIPS			
IND SF CHIX BROTH					
COFFEE CREAMER					

MISCELLANEOUS INVENTORY CHECKLIST

I T E M	AMOUNT ON HAND	I T E M	AMOUNT ON HAND
PARMESAN CHEESE	jar	OSMOLITE	cs
		VANILLA ENSURE	cs
SHREDDED CHEDDAR	bag	CHOCOLATE ENSURE	cs
TARTAR SAUCE	box	VANILLA ENSURE PLUS	cs
POP CORN	cs	CHOCOLATE ENSURE PLUS	cs
APPLE JUICE, 6 oz.	cs	VIVONEX	pkg
ORANGE JUICE, 6 oz.	cs	PREGESTEMIL	cn
V8 JUICE, 6 oz.	cs	NUTRAMIGEN	cn
DIET CATSUP	cs	ICED TEA MIX	gal
MAYONNAISE	cs	SKEWERS	box
BUTTERMILK DRESSING	gal	COKE	tank
CREAMY ITALIAN DRESSING	gal	DIET COKE	tank
RANCH DRESSING	gal	SPRITE	tank
THOUSAND ISLAND DRESSING	gal	DR. PEPPER	tank
DIET DRESSING	gal	CO_2	tank
INDIVIDUAL FRENCH DRESSING	cs	TOOTHPICK	box
INDIVIDUAL THOUSAND ISLAND DRSG	cs	SALT SHAKERS	cont
INDIVIDUAL DIET FRENCH DRESSING	cs	PEPPER SHAKERS	cont
INDIVIDUAL DIET 1000 ISLAND DRSG	cs	CAFETERIA NAPKINS	cs
THREE BEAN SALAD	tub	EASY OFF OVEN CLEANER	cn
POTATO SALAD	tub	9 oz. LIDS	cs
GRAPEFRUIT SECTION	gal	5 oz. LIDS	cs
1 oz. PORTION CUPS	box	COFFEE MUG LIDS	cs
2½ oz. PORTION CUPS	box	DOME LIDS	cs
		PATIENT NAPKINS	cs
		TRAY COVERS	cs
		COFFEE STIRS	box

APPENDIX D

Preliminary Inventory Activity Statements

PRELIMINARY INVENTORY ACTIVITY STATEMENTS

1. records quantity of items received from vendors in inventory file
2. records prices of items received from vendors in inventory files
3. adjusts quantity on hand of items returned to vendors for credit
4. prepares storeroom requisitions
5. fills storeroom requisitions
6. prepares list for advance freezer withdrawal
7. pulls items from freezer for thawing or issue to production or service
8. deducts quantity of items issued from inventory to production or service
9. adds quantity of items returned to inventory - items not used for production or service
10. writes physical inventory forms
11. does inventory of food items
12. does inventory of paper supplies
13. does inventory of equipment
14. determines quantity of items used
15. determines the value of inventory on hand
16. prepares reports of the value of inventory
17. determines adequacy of stock levels
18. determines non-usable, slow moving, or excess stocks
19. determines depleted items

APPENDIX E

Revised Inventory Activity Statements

REVISED INVENTORY ACTIVITY STATEMENTS

Perpetual Inventory

1. records quantity of items received from vendors in inventory file

2. records prices of items received from vendors in inventory file

3. adjusts quantity on hand of items returned to vendors for credit

8. deducts quantity of items issued from inventory to production or service

9. adds quantity of items returned to inventory - not used for production or service

Physical Inventory

11. does inventory of food items

12. does inventory of paper items

14. determines quantity of items used

15. determines the value of inventory

APPENDIX F

Final Inventory Activity Statements

FINAL INVENTORY ACTIVITY STATEMENTS
INCLUDING SPECIFIC INVENTORY ACTIVITIES PERFORMED
AT THE STUDY SITE

1. Perpetual Inventory

   1.1 records date of transaction

   1.2 records quantity of items received from vendors

   1.3 calculates and records balance on hand

   1.4 records prices of items received from vendors

   1.5 adjusts quantity on hand of items returned to vendors for credit

   1.6 deducts quantity of items issued from inventory to production or service

   1.7 calculates and records month-to-date usage

   1.8 adds quantity of items returned to inventory - not used for production or service

   1.9 labels new inventory cards, if necessary

2. Physical Inventory

   2.1 walks to various storage areas

   2.2 organizes storage area

   2.3 cleans storage area

   2.4 counts and records quantity of inventory item on form

   2.5 counts and records quantity of inventory item in cardex

   2.6 transfers inventory count from form to cardex

   2.7 adjusts perpetual issue or receipt information to correspond to physical count

   2.8 calculates and records month-to-date usage

   2.9 transfers month-to-date usage from inventory record card to purchase history card

2.10 calculates cost of inventory items

2.11 adds costs of inventory items

2.12 labels new inventory cards, if necessary

APPENDIX G

Perpetual and Physical Inventory Sections and Components with Corresponding Activity Statements

Perpetual and Physical Inventory Sections and Components with Corresponding Activity Statements

INVENTORY SECTIONS AND COMPONENTS	ACTIVITY STATEMENTS[a]
PERPETUAL INVENTORY	
posting receipts	
. dairy	1.1, 1.2, 1.3, 1.4, 1.9
. soda	1.1, 1.2, 1.3, 1.4, 1.9
. other vendors	1.1, 1.2, 1.3, 1.4, 1.5, 1.9
. stores	1.1, 1.2, 1.3, 1.9
posting issues	
. advance freezer	1.1, 1.3, 1.6, 1.7, 1.8, 1.9
. freezer	1.1, 1.3, 1.6, 1.7, 1.8, 1.9
. storeroom	1.1, 1.3, 1.6, 1.7, 1.8, 1.9
PHYSICAL INVENTORY	
recording	
. bread	2.1, 2.2, 2.4, 2.6, 2.8, 2.12
. dairy	2.1, 2.4, 2.6, 2.8, 2.12
. miscellaneous	2.1, 2.4, 2.6, 2.7, 2.8, 2.12
. pantry	2.1, 2.4
. produce	2.1, 2.4, 2.6, 2.8, 2.12
. stores	2.1, 2.4, 2.6, 2.8, 2.12
. freezer	2.2, 2.3, 2.5, 2.7, 2.8, 2.12
. storeroom	2.2, 2.5, 2.7, 2.8, 2.12
costing	
. cardex items	2.9, 2.10
. pantry items	2.10
. adding costs of cardex and pantry items	2.11

[a] See list in Appendix G for actual activity statements

APPENDIX H

Observation Forms

OBSERVATION FORM

DATE: _____

	TIME SPENT	NUMBER OF POSTINGS	NUMBER OF DOCUMENTS	NUMBER OF PEOPLE	R E M A R K S
A. PERPETUAL INVENTORY					
1. dairy receipts					
2. soda receipts					
3. stores receipts					
4. Cruce receipts					
5. Foodservices of America receipts					
6. Lady Baltimore receipts					
7. Manhattan Wholesale receipts					
8. Moccomat receipts					
9. Shared Service Systems receipts					
10. receipts from other vendors VENDOR:					
11. advance freezer withdrawals					
12. freezer issues					
13. storeroom issues					

(PINK)

OBSERVATION FORM

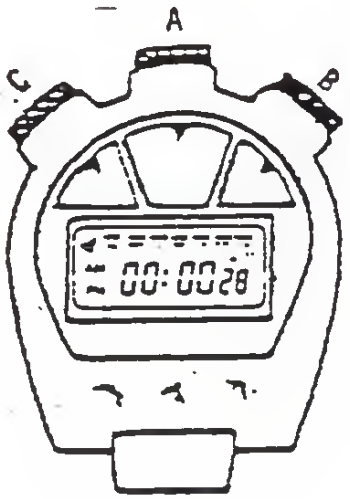
OATE: _____

	TIME SPENT	NUMBER OF ITEMS	NUMBER OF DOCUMENTS	NUMBER OF PEOPLE	REMARKS
B. RECOROING OF MONTHLY PHYSICAL INVENTORY					
1. bread inventory on form					
2. dairy inventory on form					
3. miscellaneous inventory on form					
4. pantry inventory on form					
5. produce inventory on form					
6. stores inventory on form					
7. freezer inventory in cardex					
8. storeroom inventory in cardex					
9. bread inventory from form to cardex					
10. dairy inventory from form to cardex					
11. miscellaneous inventory from form to cardex					
12. produce inventory from form to cardex					
13. stores inventory from form to cardex					
C. COSTING OF INVENTORY					
1. individual inventory items in cardex					
2. pantry inventory items					
3. adding costs of individual inventory items					

(GREEN)

APPENDIX I

Illustration of Timing Equipment



Delta Impex Sports Quartz Timer

APPENDIX J

Supplemental Tables

Table 7. Total time spent performing perpetual and physical inventory by month

inventory sections by type	June (sec.)	June (hrs.)	July (sec.)	July (hrs.)	August (sec.)	August (hrs.)	total (sec.)	total (hrs.)
perpetual[a]	←----------			time				----------→
. receipts	0	0.00	13,477	3.74	11,111	3.09	24,588	6.83
. issues	0	0.00	18,593	5.17	14,575	4.04	33,168	9.21
total	0	0.00	32,070	8.91	24,686	7.13	57,756	16.04
physical[b]								
. recording	22,233	6.18	21,159	5.88	22,293	6.19	65,685	18.25
. costing	11,956	3.32	10,507	2.92	10,335	2.87	32,798	9.11
total	34,189	9.50	31,666	8.80	32,628	9.06	98,483	27.36
total for perpetual and physical inventory	34,189	9.50	63,736	17.71	58,314	16.19	156,239	43.40

[a] refer to Table 1 for time spent performing inventory component

[b] refer to Table 4 for time spent performing physical inventory component

Table 8. [a]Average time spent performing perpetual and physical inventory

inventory sections by type	average hours[b] per month
perpetual[c]	
. receipts	3.42
. issues	4.60
total	8.02
physical[d]	
. recording	6.08
. costing	3.04
total	9.12
total for performing perpetual and physical inventory	17.14

[a] refer to Table 7 for total time spent by month

[b] average hours spent performing perpetual inventory = total hours spent performing perpetual inventory divided by two; average hours spent performing physical inventory = total hours spent performing physical inventory divided by three

[c] observations were collected for two months of perpetual inventory

[d] observations were collected for three physical inventory periods

DETERMINATION OF TIME SPENT MANUALLY PERFORMING FOODSERVICE INVENTORY ACTIVITIES IN A SMALL COMMUNITY HOSPITAL

by

EDITHA P. HEBERLEIN

B.S., University of the Philippines, 1978

AN ABSTRACT OF A MASTER'S REPORT

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Hotel, Restaurant,
Institution Management and Dietetics

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1989

ABSTRACT

The purpose of this research was to measure time spent manually performing foodservice inventory activities in a small community hospital. Specific objectives of the study were to compile a list of activities performed in a foodservice department for maintaining inventory and determine actual time spent performing perpetual and physical inventory activities manually. Activities performed in maintaining and controlling inventory were identified in the initial phase of the study. The inventory activities were then grouped by inventory type: perpetual and physical inventory. Perpetual inventory was subdivided into posting receipt and issue components and physical inventory was subdivided to recording and costing components. Each inventory component was performed, timed, and documented by the researcher.

Data analysis focused on time spent, number of postings, and mean time per posting for perpetual inventory components; and time spent, number of inventory items, and mean time per item for physical inventory components. Total time spent performing perpetual and physical inventory for the two months was computed.

During the two-month period, more time was spent posting issues than receipts and more issues than receipts were posted. More time was spent on inventory components which required price variance checks. Time was least for components whose inventory cards were easy to locate in the cardex.

Time spent recording physical inventory for freezer components required the greatest time. Recording physical inventory components took about twice as much time per component as did costing physical inventory components. Costing of cardex items required greater time than costing pantry items.

Considerably more time was spent performing physical (27.36 hours) than perpetual (16.04 hours) inventory during the two-month period. An average of eight hours per month was spent performing perpetual inventory and an average of nine hours was spent on physical inventory.